



## RHM 100

# Coriolis Mass Flow Meter for High Flow Terminal and Transfer Applications

Terminal Transfer / Viscous Fluids / Barge, Ship, Rail Car and Truck Filing





## Features

- Typical measuring range up to 12000 kg/min (26455.47 lb/min)
- Pressure ratings up to 237 bar (3437 psi)
- Temperature ratings from -196 to +210 °C (-320 to +410 °F)
- Mass flow uncertainty down to 0.1 %
- Repeatability down to 0.05 %
- 4 kHz measurement updates and response time of less than 10 ms when used with RHE 40 Series transmitters
- Accurately measure flow rates down to 150 kg/min
- The Rheonik **AnyPipeFit Commitment** provides custom process connection type and size flexibility on any meter to suit your existing plant, saving time and expense on installation costs
- Approved for use in hazardous areas
- SS 304 Stainless steel enclosure, SS 316L optional
- Integral and remote transmitter versions available

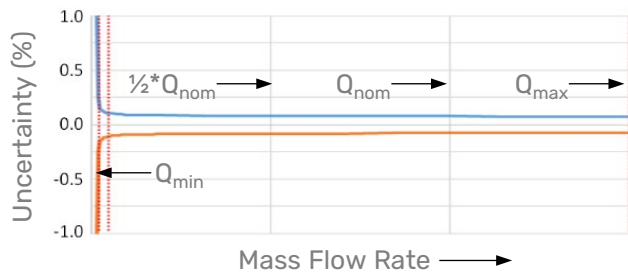
## General Specification Overview

<b>Nominal Flow (<math>Q_{nom}</math>)*</b>	10000 kg/min (22046 lb/min)
<b>Maximum Flow (<math>Q_{max}</math>)*</b>	12000 kg/min (26456 lb/min)
<b>Typical Minimum Flow (<math>Q_{min}</math>)*</b>	150 kg/min (330 lb/min)
<b>Operating Temperature</b>	Fluid temperature range options cover applications from -196°C to 210°C (-320°F to 410°F). For integral transmitter versions please refer to transmitter datasheet
<b>Ambient Temperature</b>	-50°C to 80°C (-58°F to 176°F)
<b>Pressure Ratings</b>	Up to 237 bar / 3437 psi - dependent upon material
<b>Electrical Connection Sensor w/o Integral Transmitter</b>	M20 x 1.5 standard cable entry for JM, SM terminal box versions Optional entries available : ½" NPT or M25 x 1.5 (only for SM) or ¾" NPT (only for SM) Max. cable length to remote RHE transmitter 100 m / 328 ft
<b>Sensor Enclosure Materials</b>	Stainless steel 304 (standard), SS 316L (optional) Coated aluminum terminal box, SS 316L terminal box (optional)
<b>Enclosure Type</b>	Protection class IP66 (IP66 is mostly equivalent to NEMA 4X) with Standard Temperature Range (Option N1 / NA); IP65 (IP65 is better than NEMA 4) with Temperature Ranges E2, E3, H4, H5 with recommended insulation (details see manual)
<b>Wetted Materials</b>	Flow tubes SS 316Ti, SuperDuplex or Alloy C22 Additional/customer specific materials available upon request
<b>Process Connections</b>	Nearly any – the Rheonik <b>AnyPipeFit Commitment</b> . Consult factory for types/sizes not listed in this data sheet on the Mechanical Construction pages
<b>Pressure Rating Compliance</b>	Europe – PED: Pressure Equipment Directive
<b>Certifications and Approvals</b>	ATEX / IECEx Approvals for Zone 0, 1 (details see page 10) North American Approvals Class I, Div. 1, 2, Gr. A,B,C,D, Zone 0, 1, 2 Custody transfer approval (OIML R117) American Bureau of Shipping (ABS) DNV approval for marine applications
<b>Testing and Inspection</b>	All sensors are hydro tested, calibrated and supplied with a traceable calibration certificate. Customized calibration and testing services are available
<b>Project Documentation and QA, Services</b>	Rheonik offers a full set of services for large and complex engineering projects. Typical services offered are, but not limited to: <ul style="list-style-type: none"> <li>• Certificates of origin and conformity, mill certificates</li> <li>• Data books including WPS-WPQR, WQS, NDT, test &amp; quality plans, functional testing, calibration procedures, customized packing, factory acceptance etc.</li> <li>• Painting to project specification</li> <li>• Start up and commissioning services on/offshore</li> </ul>
<b>Options</b>	Enclosure heating for high temperature applications Cleaning for oxygen service , ... For more consult factory

\* At  $Q_{nom}$  pressure drop across a parallel tube sensor will be approximately 0.5 bar (7 psi) for H<sub>2</sub>O. Sensors can be operated at higher flow rates up to  $Q_{max}$  but pressure drop will be higher. Typical Minimum Flow  $Q_{min}$  is the recommended lowest flow rate for an accurate measurement. Sensors will measure flow rates lower than  $Q_{min}$  but uncertainty will increase beyond 1% of rate.

The flow rate specifications above relate to standard pressure, parallel tube, manifold sensor versions. Models with higher pressure ratings have increased wall thickness and will have higher pressure drops.

## Calibration Options



Order Code	General Accuracy Calibration
------------	------------------------------

A	Standard - 0.20 % Uncertainty
B	Premium - 0.15 % Uncertainty

Order Code	High Accuracy Calibration
------------	---------------------------

G	Premium Plus - 0.10 % Uncertainty
---	-----------------------------------

Order Code	Focused Calibration
------------	---------------------

1	0.10 % Low Flow Calibration* <i>Requires RHE 40 Series transmitter</i>
X	Customized Calibration** Consult factory

\* Low flow calibration focuses on the range from  $\frac{1}{2}Q_{nom}$  downwards to lower flow rates than on other calibrations. Often used for low pressure gas or very viscous liquids

\*\* Customized calibration uses specific calibration points according to customer requirements

**Reference conditions:**  
18-24°C Water @ 1-3 bar

Order Code	Density Calibration / Performance (Liquid)
------------	--

N	No Density Calibration
S	Standard $\pm 0.001$ kg/l Uncertainty
D	Enhanced $\pm 0.0005$ kg/l Uncertainty Requires High Accuracy or Focused Calibration Option

### Uncertainties and flow measurement turn-down

The turn down capability from  $Q_{nom}$  of the flow sensor is driven mainly by its zero point stability. At the very low end of the measuring range the uncertainty ( $u$ ) is dominated by zero point stability.

- Zero point stability of a standard sensor with General Accuracy Calibration is: 1.5 kg/min (3.31 lbs/min).
- Zero point stability of a Gold Line sensor with High Accuracy or Focused Calibration is 1.35 kg/min (2.98 lbs/min).
- For flow  $Q \geq ZP \text{ stability} / (\text{Base Calibration uncertainty}/100) \rightarrow u = \text{calibration uncertainty}$
- For flow  $Q < ZP \text{ stability} / (\text{Base Calibration uncertainty}/100) \rightarrow u = (\text{zero stability}/Q) * 100$

### Uncertainties from environmental and process conditions

If sensors are not zeroed at operating conditions, minor additional uncertainties can arise from elevated temperatures and pressures:

- $\pm 0.00125$  % of maximum flow per °C
- $\pm 0.0001$  % of maximum flow per bar.

Process temperature effect on density:

- Additional uncertainty of  $\pm 0.00008$  g/cm<sup>3</sup> per °C difference from calibration temperature with standard density calibration
- Additional uncertainty of  $\pm 0.000009$  g/cm<sup>3</sup> per °C difference from calibration temperature with enhanced density calibration.
- This effect can be mitigated by a simple field density adjustment at operating conditions.

Process pressure effect on mass flow:

The effect of pressure on flow measurement is 0.02 % of rate per bar. Compensation is possible by pressure sensor input (analog input or digital write) or manual value entry into the transmitter.

Process pressure effect on density:

- The effect of pressure on density measurement is 0.00003 g/cm<sup>3</sup> per bar. Compensation is possible by pressure sensor input (analog input or digital write) or manual value entry into the transmitter.

*Premium Plus, Ultimate, Low Flow and Enhanced Density Calibration are only available in SS 316 material, P1 lower pressure and N1 temperature range.*

*Applying Premium Plus calibration to higher pressure, special materials and/or non-standard temperature models will show higher zero uncertainties (up to 3 times higher than standard sensor).*

### Flow Measurement Repeatability

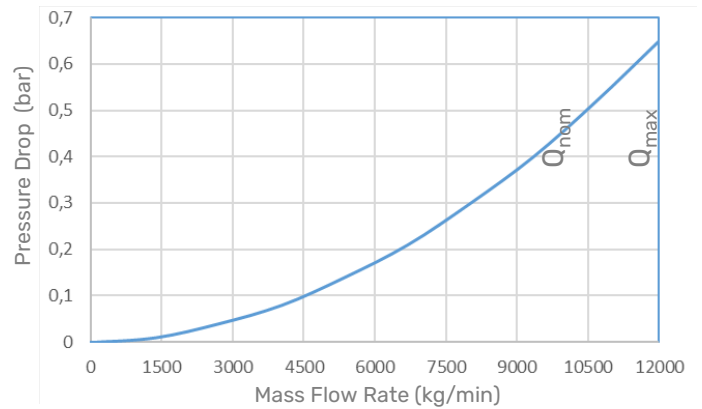
Standard Sensors  $\pm 0.1$  % of rate  
Gold Line Sensors  $\pm 0.05$  % of rate

### Temperature Measurement

Better than  $\pm 1$  °C

## Pressure Drop

Every Coriolis flow sensor generates pressure drop across its inlet and outlet when in use. The amount of pressure drop generated is mainly a function of the flow velocity within its tubes and the flowing viscosity of the stream.



0 – 12000 kg/min water, sensor with P1 pressure rating.  
Higher viscosities create higher pressure drop

## Measurement Tube Materials and Pressure Ratings

The maximum pressure ( $p_{max}$ ) of a sensor is determined by its lowest rated part. The lowest rated part can be either the measurement tube ( $p_{max}$  see table to the right), the connection block/manifold ( $p_{max}$  indicated in the mechanical construction section) or the process connection (for  $p_{max}$  see published standards or manufacturer information).

Order Code	Material	50°C / 122°F	120°C / 248°F	210°C / 410°F
P0	SS 316Ti (standard)	73 1059	66 957	57 827
P0	Alloy C22	94 1363	83 1203	71 1029
P1	SuperDuplex*	237 3437	208 3017	188 2727

\* Note minimum operating temperature for SuperDuplex stainless steel is -40 °C

Units: bar / psi

### Other Materials

Other wetted materials may be possible for chemical compatibility, lower pressure drop, abrasion allowance, other application specific requirements. Rheonik can provide nearly any material for the wetted parts.  
Contact factory with specification for assessment and availability.

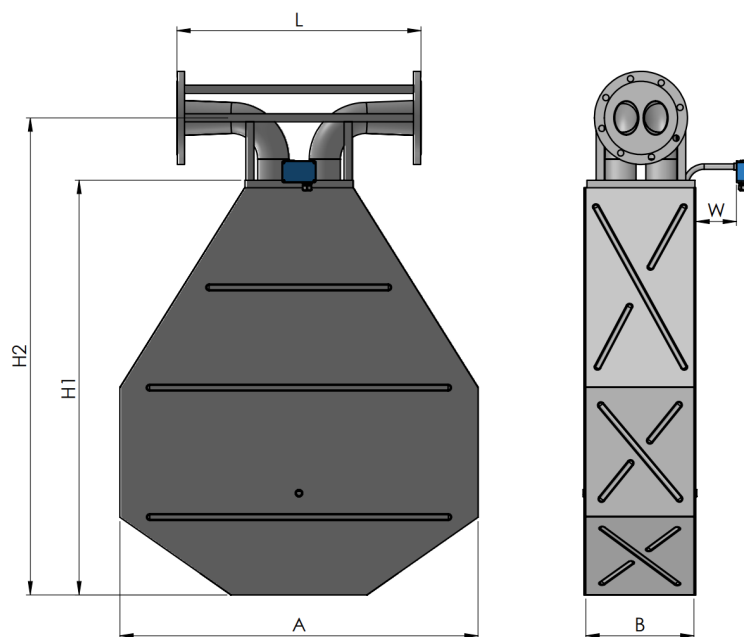
## Mechanical Construction

Sensors are manufactured with two internal measurement tubes arranged side by side. In parallel or dual path sensors, these tubes are connected in parallel, and the flowing fluid is split equally between them. In sealless designs, the measurement tubes are continuous between the process connections and do not have seals.

### Sealless design with flanged/hub process connections

Parallel tube / dual measurement path

Order Code: PFO



PFO Process Connection	Dim. L mm / in	Order Code
ANSI 8" 150# RF/SF	900 / 35.43	A1
ANSI 8" 300# RF/SF	900 / 35.43	A2
ANSI 8" 600# RF/SF	900 / 35.43	A3
ANSI 8" 1500# RTJ	900 / 35.43	R1
ANSI 8" 900# RTJ	900 / 35.43	R3
DIN DN200/PN16 Form B1	900 / 35.43	D0
DIN DN200/PN40 Form B1	900 / 35.43	D1
DIN DN200/PN100 Form B2	900 / 35.43	D2
Flange JIS B 2220 RF 10k 200A (8")	900 / 35.43	J1
Flange JIS B 2220 RF 10k 200A (8")	900 / 35.43	J2

PFO Dimensions	mm	in
A	1320	51.97
B	403	15.87
H1	1528	60.16
H2	1758	69.21
W	150	5.91

### Weights and Shipping Dimensions

- Approx. weight with 8" 150# flanges: ~520 kg / 1146 lb
- Shipping in wooden crate as per ISPM 15: ~220 x 160 x 90 cm (87 x 63 x 36 in)
- Gross weight with RHE28 transmitter: ~750 kg / 1654 lb

#### Note

All dimensions are for standard products. For customization of face to face length and/or process connection types other than the ones listed on this page, please consult factory. Note that larger diameter flange process connections are always possible. The tolerance of the process connections is  $\pm 3$  mm.

## Electrical connection to transmitter compatibility

Electrical connection option selections are compatible with the transmitter range according to the following table. Note that economical blind front versions of some transmitters are available where displays and keypads are not required. The wide range of Rheonik sensors and transmitters provide tremendous options for system designers and end users alike.

Sensor Connection Options	Order Code						
		JM	SM	S9	TM	J5	J9
	RHE 21	✓	✓	—	✓	—	—
	RHE 26	✓	✓	—	✓	—	—
	RHE 27	✓	✓	—	✓	—	—
	RHE 28	✓	✓	—	✓	—	—
	RHE 42	✓	✓	—	✓	—	—
	RHE 45	—	—	—	—	✓	—
	RHE 46	✓	✓	—	✓	—	—
	RHE 49	—	—	✓	—	—	✓





## Options Codes

Order Codes	
NN	Without Option
H1	Heating for Housing, Steam - Connection DN25 PN40
H2	Heating for Housing, Steam - Connection 1" ANSI 150 RF
H3	Heating for Housing, Steam - Connection 1" ANSI 300 RF
SB	Housing and base plate in SS 316 - check with factory for lead time
T1	Terminal box with cable entry upwards/gas installation

List multiple options in the sensor part number in the same order as the above list

## Manufacturing Instructions

Order Code	
N	No additional manufacturing instructions
O	Special Cleaning, fat free
S	Sea-worthy packing

List multiple options in the sensor part number in the same order as the above list

## Options

Order Code ORHM-...	
E1	Terminal box prepared for ½" NPT cable entry
E2	Terminal box prepared for M25x1.5 cable entry <i>(only with electrical connection SM)</i>
E3	Terminal box prepared for ¾" NPT cable entry <i>(only with electrical connection SM)</i>
E5	Terminal box prepared for M20 x 1.5 cable gland in SS 316L <i>(only with electrical connection SM)</i>
E6	Terminal box prepared for ½" NPT cable entry in SS 316L <i>(only with electrical connection SM)</i>
TP	Separate TAG Plate in Stainless Steel <i>(TAG information only)</i>
TC	Type Label in Stainless Steel <i>(TAG and all other label information)</i>

Standard cable entry on JM, SM terminal box is M20 x 1.5. Cable entry on PM terminal box is always M16 x 1.5

## Hazardous Area Certifications

Order Code	Zone / Division	Approval	Labeling
A1	Zone 1	ATEX IECEX	⊕ Ex II 2G Ex ib IIC T6...T1 Gb Ex ib IIC T6...T1 Gb
A0	Zone 0	ATEX IECEX	⊕ Ex II 1G Ex ia IIC T6...T1 Ga Ex ia IIC T6...T1 Ga
C0	Div 1, Zone 0	USA Canada	Class I, Div 1, Groups A, B, C and D T6...T1; Class I, Zone 0, AEx ia IIC T6...T1 Ga, Ex ia IIC T6...T1 Ga



## About Rheonik

Rheonik has but one single purpose: to design and manufacture the very best Coriolis meters available.

Our research and engineering resources are dedicated to finding new and better ways to provide cost effective accurate mass flow solutions that provide value to our customers. Our manufacturing group care for each and every meter we produce from raw materials all the way to shipping, and our service and support group are available to help you specify, integrate, start-up and maintain every Rheonik meter you have in service. Whether you own just one meter or have hundreds, you will never be just another customer to us. You are our valued business partner.

Need a specific configuration for your plant? Don't compromise with a "standard" product from elsewhere that will add extra cost to your installation. If we can't configure it from our extensive and versatile product range, our exclusive **AnyPipeFit Commitment** can have your flow sensor customized with any size/type of process connection and face to face dimension you need.

No matter what control system you use as the backbone in your enterprise, with our **AnyInterface Commitment**, you can be sure that connection and communication will not be a problem. Alongside a wide variety of discrete analog and digital signal connections, we can also provide just about any network/bus interface available (for example: HART, ProfibusDP, ProfiNet, EtherCAT, PowerLink, EtherNet/IP, CAN, ....) with our RHE 40 Series family of transmitters. Rheonik RHE 40 Series transmitters can connect to your system – no headache and no conversion needed.

Rheonik Messtechnik GmbH  
Rudolf-Diesel-Straße 5  
D-85235 Odelzhausen  
Germany

Tel + 49 (0)8134 9341-0  
Info@rheonik.com

